DESCRIPTION (WITH FIGURES) OF A YOUNG SPECIMEN OF *ORNITHORHYNCHUS ANATINUS* FROM THE COLLECTION OF THE AUSTRALIAN MUSEUM, SYDNEY.

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(Plate xlix.)

Opportunities of studying the anatomy of young ("foetal") specimens of *Ornithorhynchus* have seldom occurred to the scientific investigator, if we may judge from the paucity of published descriptions of such specimens.

The explanation of this fact is obvious enough if we remember that the eggs of the animal are laid while the development of the embryo is yet at a very early stage (according to Caldwell* at a stage equivalent to that of a 36 hours' chick), and that the further development, both within the egg and probably for a prolonged period after hatching, goes on in the nest situated at the end of a lengthy burrow which is rather difficult of discovery and by no means easy of access.

In consequence of the absence both of pouch and of teat in the platypus, the young animal during the period of development which answers to that of the "mammary foetus" of the marsupial, is probably either wholly unattached or only very insecurely and temporarily attached to the person of the mother. Thus, even if the latter emerges at all from the burrow during the period of nurture of her offspring, as is likely enough, it is improbable that she bears her young about with her. That she should do so habitually is indeed excluded by the aquatic habits of the species. The capture of adult females in a state of lactation has been recorded, but the young naked "mammary foetus" has never been obtained save in the nest. In this respect the habit of the

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* Caldwell: Journ. & Proc. Roy. Soc. N.S.W. xviii. p. 117.

Ornithorhynchus would seem to differ from that of the kindred genus *Echidna*, in whose case there is ample evidence that the mammary foetus is borne about, either occasionally or habitually by the mother.* (The incubating egg itself seems to be carried in a temporary pouch in *Echidna.*†). Here the very imperfect marsupium or bilateral pouch-like fold of the integument, which is present during lactation, affords at least a partial support in default of a nipple, while a similar pouch appears to be lacking in the *Ornithorhynchus.*

In view, therefore, of the rarity of examples of what I have already referred to as the "mammary foetus" of the platypus, the present description of one that I believe to be slightly younger than any hitherto described may be not unwelcome to comparative anatomists.

For this very valuable acquisition I am greatly indebted to the liberality of the Trustees of the Australian Museum in Sydney, who were good enough to place it at my disposal along with a young *Echidna* to enable me to continue certain investigations into the anatomy, more particularly of the head, of the Monotremes.

It is to be hoped that ere long we shall have more abundant light thrown upon the embryology and foetal anatomy of *Ornithorhynchus* and *Echidna* from the researches of European anatomists into the developmental material which we are led to believe has been accumulated at considerable expense by both English and German naturalists.

It is perhaps permissible in the interests of British science to express a keen regret that hitherto so little has come to light as product of Mr. Caldwell's fully equipped expedition of over ten years ago. It is indeed somewhat humiliating to English-speaking zoologists that after the highly auspicious beginning and the apparently successful conclusion of that important and longdesired undertaking they should be found looking forward rather to the results of the labours of Professor Semon and his colleagues now in course of publication in Jena, than to those of Mr. Caldwell which might have been expected to emanate from Cambridge.

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* Owen : "On the marsupial pouches, mammary glands, &c., of the *Echidna hystrix.*" Phil. Trans. 1865, pp. 671-86.

† Haacke, W. : "On the marsupial ovum, the mammary pouch and the male milk glands of *Echidna hystrix.*" Proc. Roy. Soc. xxxviii. p. 72.

In this short paper I propose merely to give a description of the external characters of my specimen which I had very carefully drawn by Mr. G. H. Barrow prior to any interference with it in the way of dissection.

I may premise that my examination of the external anatomy of the young animal reveals nothing really new, and in fact enables me to add little to Owen's description of a somewhat similar specimen published nearly sixty years ago. So far as I have been able to discover only three young *Ornithorhynchi* have yet been described and figured, the youngest being the specimen just referred to. This was described and figured, along with a larger one, by Sir Richard Owen in Trans. Zool. Soc. Vol i. 1835, p. 221 *et seq.*, (Pl. XXXII.-III.), and also in Todd's Cyclopædia of Anat. and Physiol. Vol. iii. "*Monotremata*," where an additional figure is given. The late Dr. George Bennett of Sydney in the same Volume of the Trans. Zool. Soc. p. 252, refers to his discovery, in a burrow, of three young *Ornithorhynchi* having a length of $1\frac{7}{8}$ inch, but unfortunately he was unable to preserve them. It is possible or even probable that they were slightly younger than the one here dealt with, but as he does not indicate whether or not the measurement followed the contour of a curved body, it is impossible to say. My specimen is only 40 mm. in length if the distance between the extreme points of the apparently naturally curved body be taken, while it is exactly double that length if the dorsal contour line from tip to tip of snout and tail be measured. In any case Dr. Bennett gave no further description or drawing of his specimens if we except a reference to them as "only thinly covered with hair," a statement which Owen quotes,* but which is unintelligible to me, for sections recently made showing the structure of the skin of my specimen prove that the development of the hair follicles is still in the earlier stages, and that nowhere have hair-shafts as yet approached the surface of the epidermis, which was perfectly naked.

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* Todd's Cyclop. Vol. iii.

Besides Owen's two specimens the only other one known to me is one which came into the possession of the late Professor W. K. Parker and whose external characters were partly described and a figure of it given (p. 25) in his "Mammalian Descent" (Lond. 1885). More elaborate drawings (life-size) of this specimen have quite lately been published by Professor E. B. Poulton in the Quart. Journ. Microsc. Sci., Vol. xxxvi., in connection with his paper on the hairs, &c., of *Ornithorhynchus.* Mr. Poulton also gives a list of memoirs dealing with the anatomy of portions of this specimen.

From the drawings of Parker's specimen I have estimated the length of the dorsal contour line from the tip of the snout to the tip of the tail as about 250 mm. It was thus very considerably larger than mine, in which the same line is only 80 mm.

One of Owen's two specimens was also much larger, so that his smaller specimen is the only one with which one can rightly compare the subject of the present paper.

The specimen (which had been labelled as from the Patterson River) has been very satisfactorily preserved in alcohol, as microscopical sections subsequently made bear witness. Cellular structure and arrangement are well shown and karyokinetic figures are abundant, at least in the epidermis. It is perfectly intact with the exception of a small apparently accidental skin-incision on the ventral aspect of the neck (shown in figure 3), and two other very small abrasions on the skin of the back and abdomen. The general integument is quite naked and marked throughout by delicate transverse wrinkles, which are probably of post-mortem production, and are neither so numerous nor so pronounced as those figured in Owen's specimen (Trans. Zool. Soc. Vol. i. Pl. XXXII.). The long axis of the animal is markedly curved, the convexity being dorsal. The contour of the dorsal surface forms rather more than a semicircle of slightly unequal curvature throughout. (In Parker's specimen the contour formed nearly a complete circle as shown in Poulton's plate.) The dorsal contour line from tip to tip as already stated measures 80 mm., while the distance between the extreme points of the curved body (vertex to root of tail) in a straight line, is 40 mm. There is no distinct cervical constriction, a "neck" being practically absent. The distance from the tip of the snout to the anterior border of the forelimb is 15 mm.

The maximum breadth of the head is 11 mm. The snout is sharply separated from the rest of the head by the developing lappet-like fold of integument which forms so prominent a feature at the base of the adult muzzle. This has here the character of a collar-like ridge and is continuous all round the root of the muzzle, though just at or above the elevated angles of the gape which reach up to it, it is somewhat lower than elsewhere and is slightly overlapped by the somewhat projecting hinder angle of the upper lip or maxillary lobe. The length of the snout is proportionately small both to the rest of the head and to its own width. It is 4·5 mm. long from tip to basal groove in front of lappet, while it measures 6·5 mm. in width.

The gape has a sinuous outline and is a simple fissure throughout which is almost closed. No trace of the tongue can be seen from the outside nor any vestige of the integumentary folds which, according to Owen, united the upper and lower lips across the angle of the mouth in his specimen. The upper lip throughout slightly overhangs the sinuous gape, whose posterior extremities turn somewhat dorsally where they reach to the collar-like lappet.

The nostrils are situated dorsally and about 1·5 mm. behind the anterior end of the snout. Between, and just in front of the interval betwixt these, the dorsal surface of the snout is sharply elevated into a very prominent "caruncle," which also projects very slightly forward so that it almost reaches the coronal plane of the anterior margin of the snout. The tip of this caruncle is whiter than its surroundings and evidently forms the epidermal covering which was presumed by Owen to exist over the "minute fleshy eminence lodged in a slight depression" and "surrounded by a discontinuous margin of the epidermis" observed by him.

The position of the eye is not marked by wrinkles but is smooth and rounded and is indicated by the line of the closed ocular fissure which extends back for a distance of 2 mm. from a point 1·5 mm. behind the lappet at the base of the muzzle. The pigment of the eye can be seen around this faintly appearing through the continuous integument of the region.

The position of the ear is indicated by the slight integumentary depression of the external auditory meatus just behind the ocular fissure and 4·5 mm. behind the lappet.

The dorsal and ventral surfaces of the forelimbs are directed forwards and backwards respectively, the preaxial and postaxial borders being respectively mesial and lateral. The forelimbs are separated at their bases by a much wider interval than are the hind limbs, and they do not incline towards each other as do the latter whose dorsal and ventral surfaces look outwards and inwards respectively, the borders being actually as well as morphologically pre- and postaxial.

The free distal margins from which the digits spring in both hand and foot are crescentic.

The digits are well-marked and they all already possess claws, but those of the toes are much smaller than those of the fingers.

The natatory membrane of the manus is present as a free lappet-like fold of its integument at the palmar aspect of the roots of the fingers and it already reaches about as far as the nail-tips. It is this fold which really forms the distal margin of the hand, ventrad of the digits, seen in fig. 3.

In the corresponding situation in the pes there is merely a slight integumentary ridge.

The length of the free portion of the hind limb is about 7 mm. and of the forelimb perhaps a trifle less.

A trace of the calcanean spur is present in the hind limb as a very minute papilla on the ventral (internal) aspect of the limb, but it is hidden away in the flexure between the limb and the abdomen in the ordinary position of the limb.

The cloacal aperture is situated ventrally close to the root of the tail. A small papilla is visible in the aperture. It is impossible yet to determine the sex of the specimen, as the external characters are insufficient.

The tail is flat ventrally and convex dorsally. It measures 11 mm. in length and 6 mm. in its maximum breadth.

As Professor W. Newton Parker* has so recently instituted a comparison between the young mammary foetus of *Echidna* and that of *Ornithorhynchus*, it is unnecessary for me again to call attention to the interesting resemblances and comparatively slight differences in external characters between them. I cannot, however, agree with Professor Parker in his remarks concerning the horny character of the snout in either young or adult Monotremes. Thus he indicates as a point of similarity between the young of the two genera that in each case the snout is "horny and immobile," and he states that in the older of his stages of the *Echidna* the "horn" is thicker than in the younger. Upon this he observes "this is the more remarkable as in the adult the skin in this region can hardly be said to be horny at all." Most certainly it cannot. No epithet could well be further from the mark than "horny" as applied to the skin of the snout of the adult *Echidna*, which is, on the contrary, a very soft and delicate skin, wrinkly and freely movable upon the deeper parts.

But I cannot understand why the term "horny" should be applied to the general epidermis of the snout of the foetus in either genus. The snout of the foetal platypus dealt with in this paper is at all events no more "horny and immobile" than is that of the young mammary foetus of a marsupial, with this sole exception that over the very limited area of the caruncle the corneous epidermis is perhaps a little thicker and denser than elsewhere. Sections of the snout which have lately been made show that, except over the above area, there is no yellow reaction at all to a double stain of picric acid and hæmatoxylin, and the stratum corneum is relatively quite a thin layer, even over the caruncle, where, however, it does show the yellow picric stain indicating a process of cornification. Further I have in my possession two young Echidnæ in which the spines are just beginning to show and in neither of them is there any " horny " character of the snout.

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* P.Z.S. June, 1894.

In a note appended to his memoir, Professor Parker, after quoting from a paper by Dr. C. J. Martin and the writer† to the effect that the skin of the snout of the adult *Ornithorhynchus* is "no more horny than that of a dog's nose," makes the following comment :—"There is no doubt, however, that in my specimens of the young of both genera the horny layer of the epidermis covering the muzzle is so thick as to justify one in speaking of a " horny " snout, even though this is of course more flexible than the beak of a turtle or bird."

But if mere thickness of the stratum corneum of the epidermis will justify one in speaking of such a structure as composed of horn or " horny," one may with equal propriety speak of man as possessing a " horny " foot, seeing that the skin of the human heel possesses a stratum corneum vastly thicker in proportion than that of the skin of the snout of Monotremes, young or old, of either genus.

I am aware indeed that the British working-man is sometimes described—for rhetorical purposes—as a " horny-handed son of toil," but hitherto I have not taken this epithet as giving a literal and scientific description of his palmar epidermis.

On this principle of interpretation, of course, the whole superficial epidermal layer or stratum corneum is a layer of " horn "; but surely something more than this general and far from novel proposition is implied when it is stated that the *Ornithorhynchus* possesses a " horny beak." *And whatever more is implied is erroneous.*

Surely to justify the description of a structure as " horny " we must have, not merely a thick stratum corneum, but some such further chemical and physical transformation of it or of the " stratum lucidum " as that which gives rise, *e.g.*, to the nails, and which is entirely lacking in the general epidermis of the muzzle of the *Ornithorhynchus.* As matter of fact the skin of the snout of both young and adult *Ornithorhynchi* possesses a stratum corneum which is only *moderately* thick, which is as soft and flexible as epidermis elsewhere, whose cell-outlines and nuclei remain distinct right to the surface and which is traversed by innumerable sweat-ducts and the delicate tactile rod-organs. In view of these characters and in the absence of any special physico-chemical transformation of the tissue, as distinct from what occurs in the general epidermis, *e.g.*, of a dog's nose or of the human hand or foot, I can see no purpose or meaning in retaining the old and thoroughly misleading idea of the "horny" character of the "beak" of the "duck-billed platypus."

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† Macleay Memorial Vol. (Sydney, 1892).

The special histological characters of the caruncle will be treated of in a future publication.

EXPLANATION OF PLATE.

Fig. 1.—"Mammary foetus" of *Ornithorhynchus anatinus.* Life size. Ventral aspect.

Fig. 2.—The same. Life size. Lateral aspect.

Fig. 3.—The same. × 3 diams. Ventro-lateral aspect (right).